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Ventilation Systems and its Role in Disease Transmission

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Aim:

1. To reduce or eliminate the potential for airborne viruses to accumulate to infectious levels within an enclosed space.
2. To significantly reduce the number of Hot Spots and Super Spreader Events occurring within public spaces and to prevent these from becoming repeat venues.
3. To empower people, enabling them to protect themselves and others as well as manage and sustain low risk public spaces.

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"The main transmission route of SARS-CoV-2 is through the air (airborne transmission)."

Delta Variant ?

PubMed.gov

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Review > Infez Med. 2021 Mar 1;29(1):10-19.

Airborne transmission of SARS-CoV-2 is the dominant route of transmission: droplets and aerosols

Ali A Rabaan [1], Shamsah H Al-Ahmed [2], Maysaa Al-Malkey [3], Roua Alsubki [4], Sayeh Ezzikouri [5], Fadel Hassan Al-Hababi [6], Ranjit Sah [7], Abbas Al Mutair [8], Saad Alhumaid [9], Jaffar A Al-Tawfiq [10], Awad Al-Omari [11], Ayman M Al-Qaaneh [12], Manaf Al-Qahtani [13], Raghavendra Tirupathi [14], Mohammad A Al Hamad [15], Nadira A Al-Baghli [16], Tarek Sulaiman [17], Arwa Alsubait [18], Rachana Mehta [19], Elfadil Abass [20], Maha Alawi [21], Fatimah Alshahrani [22], Dhan Bahadur Shrestha [23], Mohmed Isaqali Karobari [24], Samuel Pecho-Silva [25], Kovy Arteaga-Livias [26], D Katterine Bonilla-Aldana [27], Alfonso J Rodriguez-Morales [28]

Affiliations + expand

PMID: 33664169

Free article

April / May 2021: WHO & CDC agree that SARS-Cov-2 is airborne

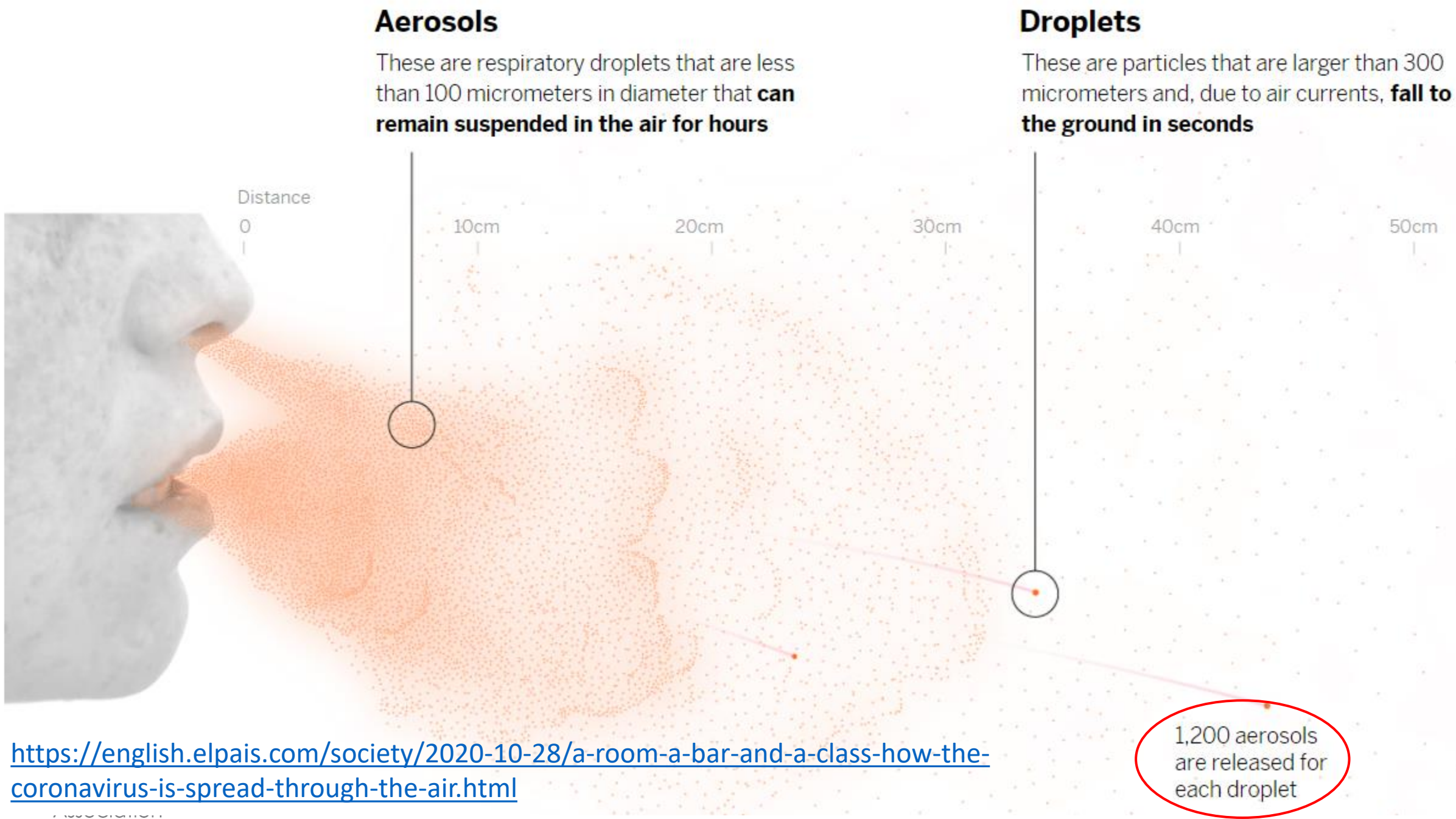
SARS-CoV-2 Transmission:

1. Infections are being driven by the delta variant which is far more transmissible than previous variants.

2. Now more than ever we need to adhere to the basic precautions.

3. We know that indoor gatherings particularly with poor ventilation are the major cause of outbreaks and super spreader events.

4. Always ensure that windows are open and that there is a constant flow of fresh air.



https://english.elpais.com/society/2020-10-28/a-room-a-bar-and-a-class-how-the-coronavirus-is-spread-through-the-air.html

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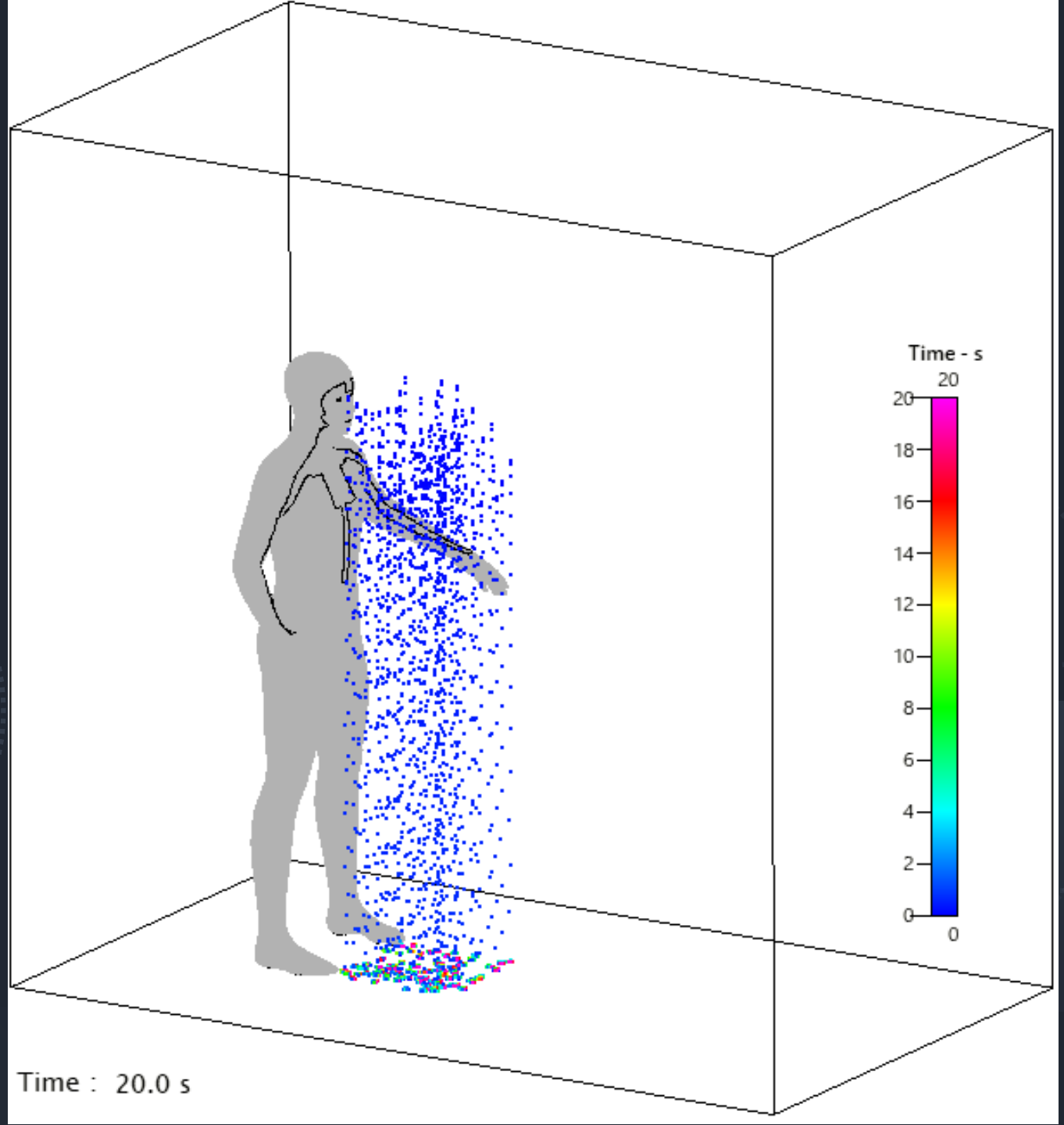
Droplets and aerosols

320 µm size particles immediately fall under gravity



https://athenasys.co.jp/main/product/cfd-ace/spray/spray_on_virus_diffusion_en.html

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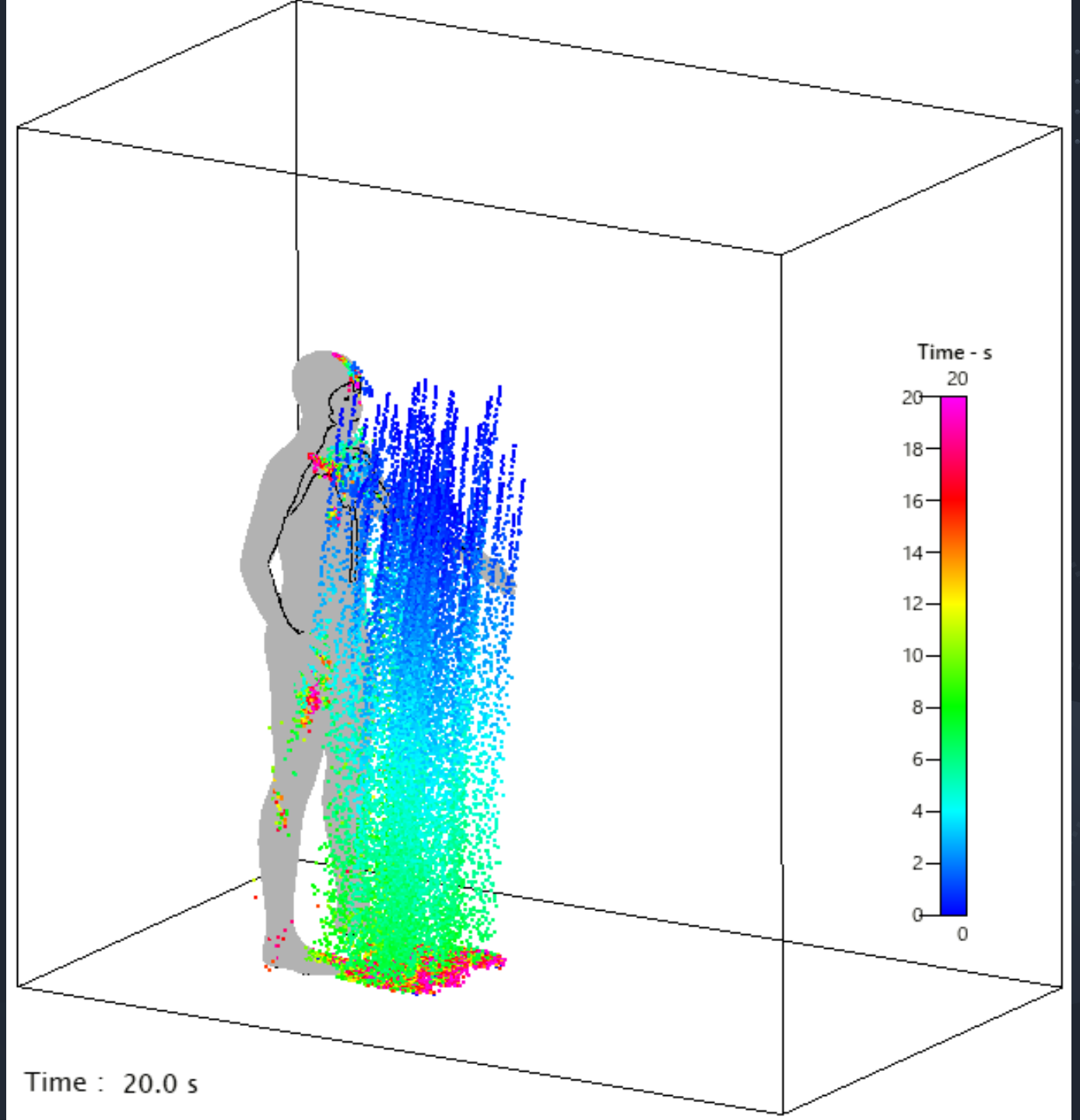
80 µm size particles fall away from the face under the gravity, but also move with the airflow around the body, quite a few collide with or adhere to the body.

https://athenasys.co.jp/main/product/cfd-ace/spray/spray_on_virus_diffusion_en.html



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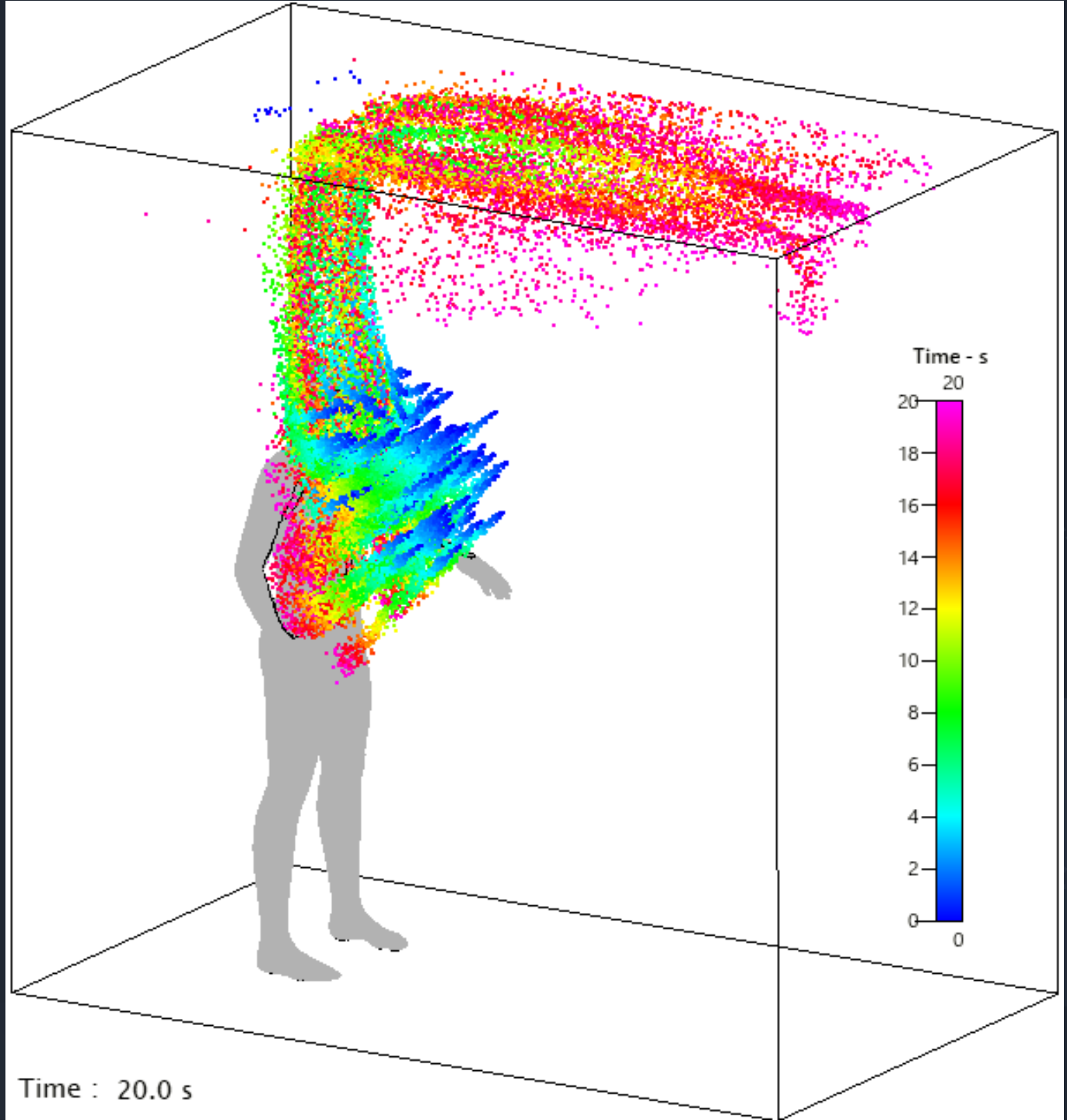
20 µm size particles fall slowly under gravity, but are mainly transported to the ceiling by rising airflow due to buoyancy.



https://athenasys.co.jp/main/product/cfd-ace/spray/spray_on_virus_diffusion_en.html

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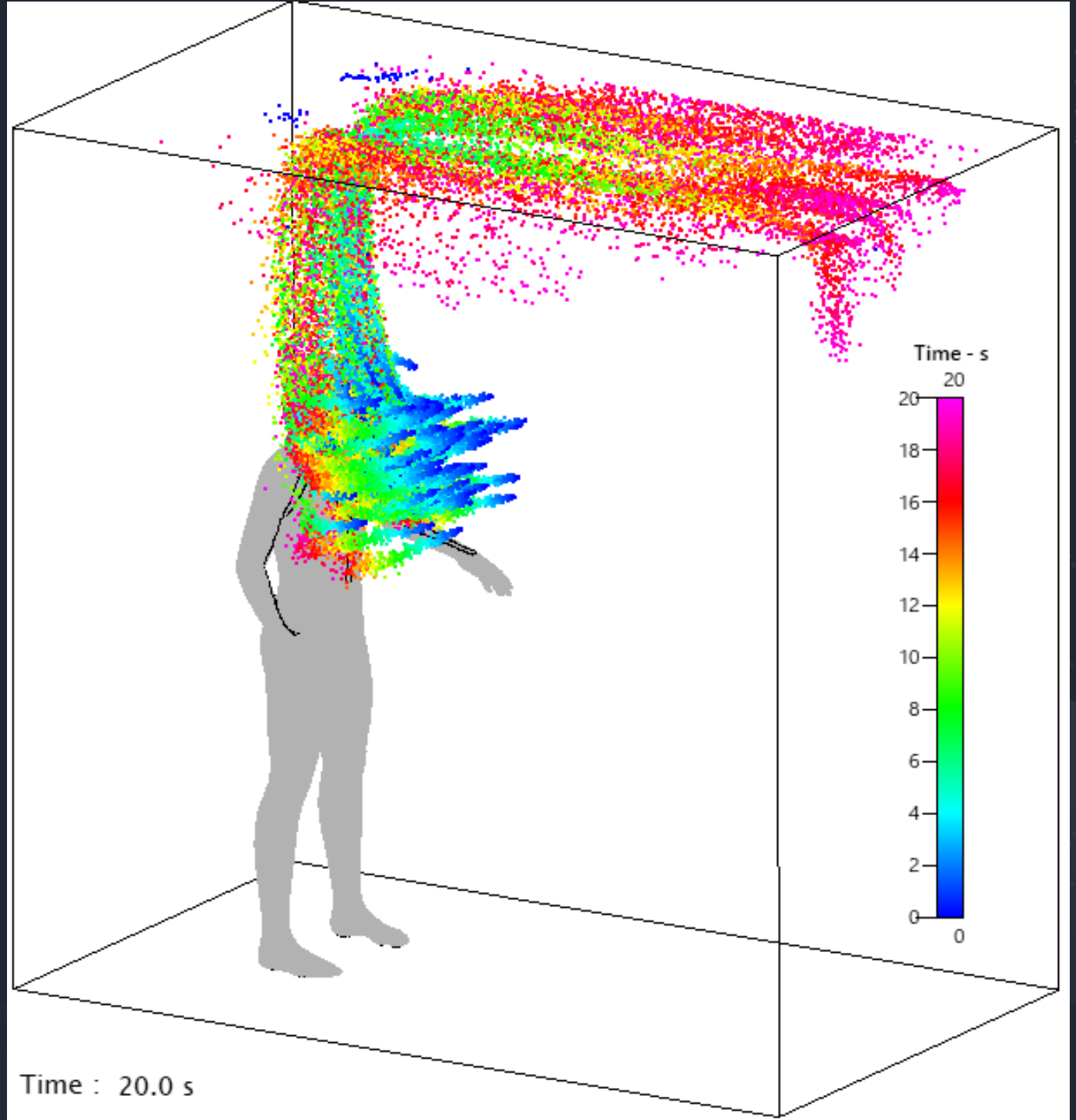
5 µm size particles are more easily transported to the ceiling due to buoyancy as well as the weaker effect of gravity.



https://athenasys.co.jp/main/product/cfd-ace/spray/spray_on_virus_diffusion_en.html

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VENTILATION :

a) is the process of providing outdoor (fresh) air to occupants within a building and removing stale air that may be contaminated.

b) It is widely recognised as a key mechanism for controlling the transmission of airborne infections.

VENTILATION is mainly provided in 3 ways:

1) mechanical ventilation using fans and ducts,
2) natural ventilation which relies on passive flow through openings (doors, windows, vents), or
3) a combination of the two.

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AIRFLOW:

Is the way the air flows through a space, i.e. its direction, and its ability to remove stale / rebreathed air that may be contaminated with SARS-CoV-2.

a) Re-circulation of re-breathed air (heated or cooled),
b) turbulent flow and
c) stale or stagnant areas within the indoor space.

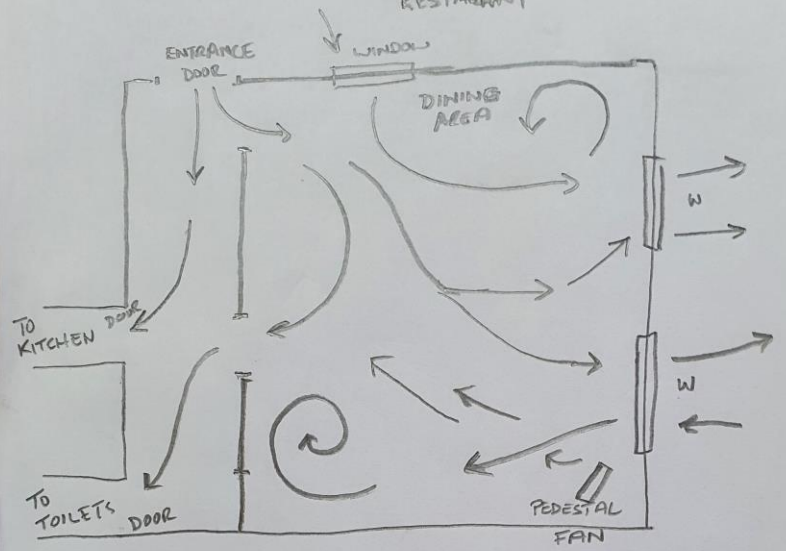
Step 1:

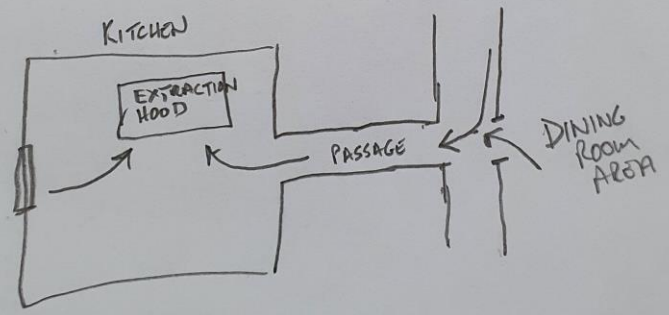
1. Determine the location of **all natural openings** such as windows, doors and passive vents, within each room.

2. Determine the location of **all mechanical airflow systems** such as supply and extraction fans, pedestal fans, mounted fans, extraction hoods, split unit air-conditioners and HVAC systems (intakes and diffusers).

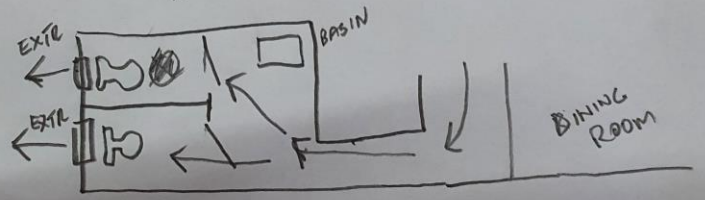
15/3/24

RESTAURANT



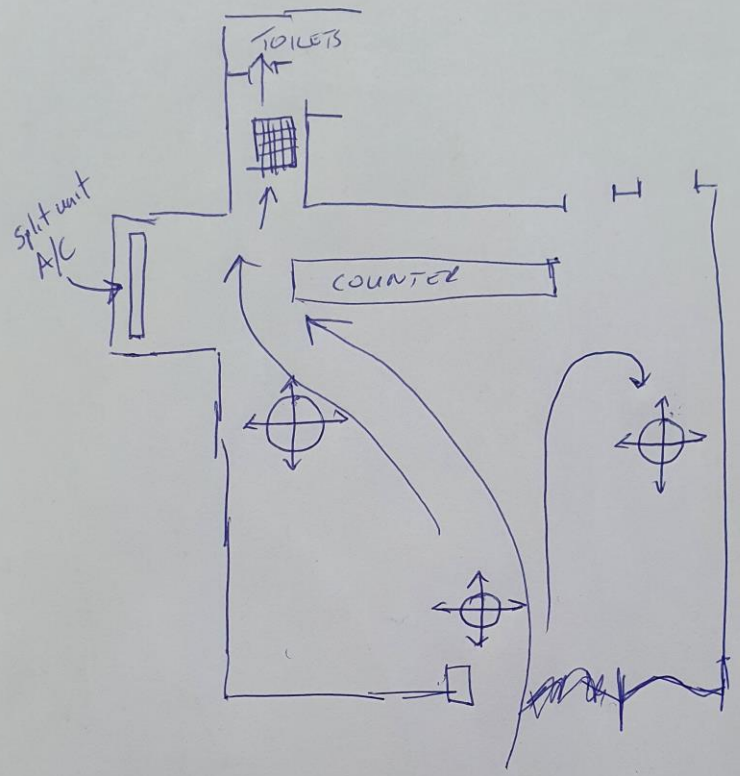


TOILET



Examples of plans with arrows indicating airflow into and out of the rooms:

HAIR CO.



Diffusers

Return Air

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Step 1 continued:

Identifying Airflow Systems
(and remember this terminology)

1. Passive Vents:
2. Air movement Fans
3. Supply and Extraction Fans:
4. Split Unit Air-Conditioners:
5. HVAC or Central Air-Conditioning systems:

Step 1 continued:

1. Examples of Passive Vents:

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Step 1 continued:

2. Examples of Air Movement Fans:

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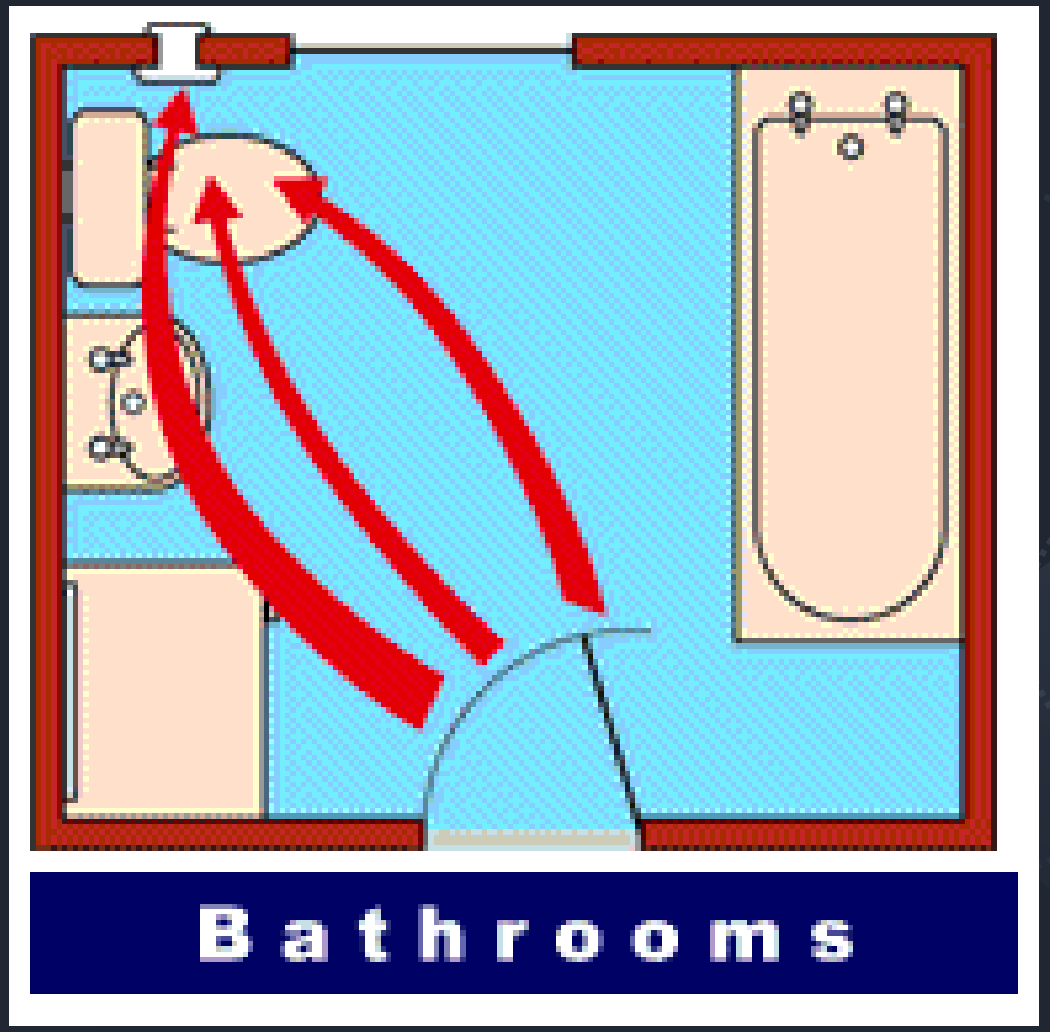
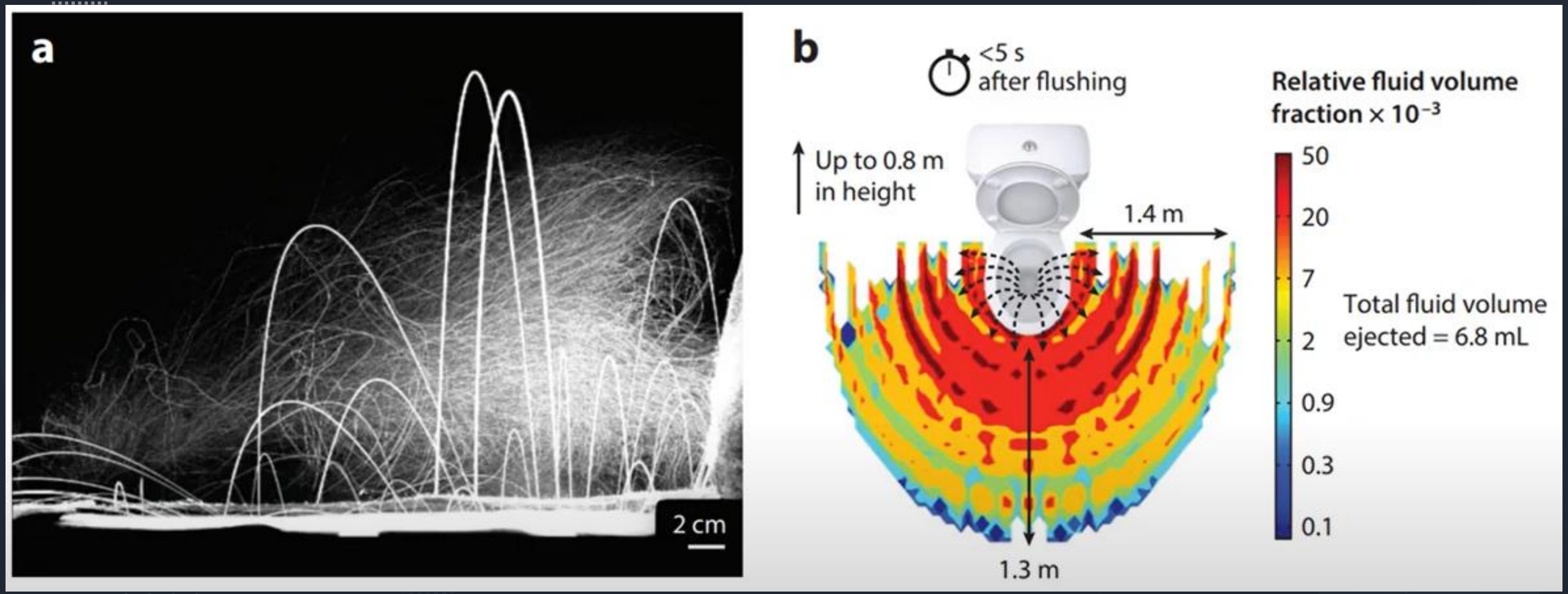
Step 1 continued:

2. Examples of Supply and Extraction Fans:

Step 1 continued:

2. Examples of Supply and Extraction Fans:





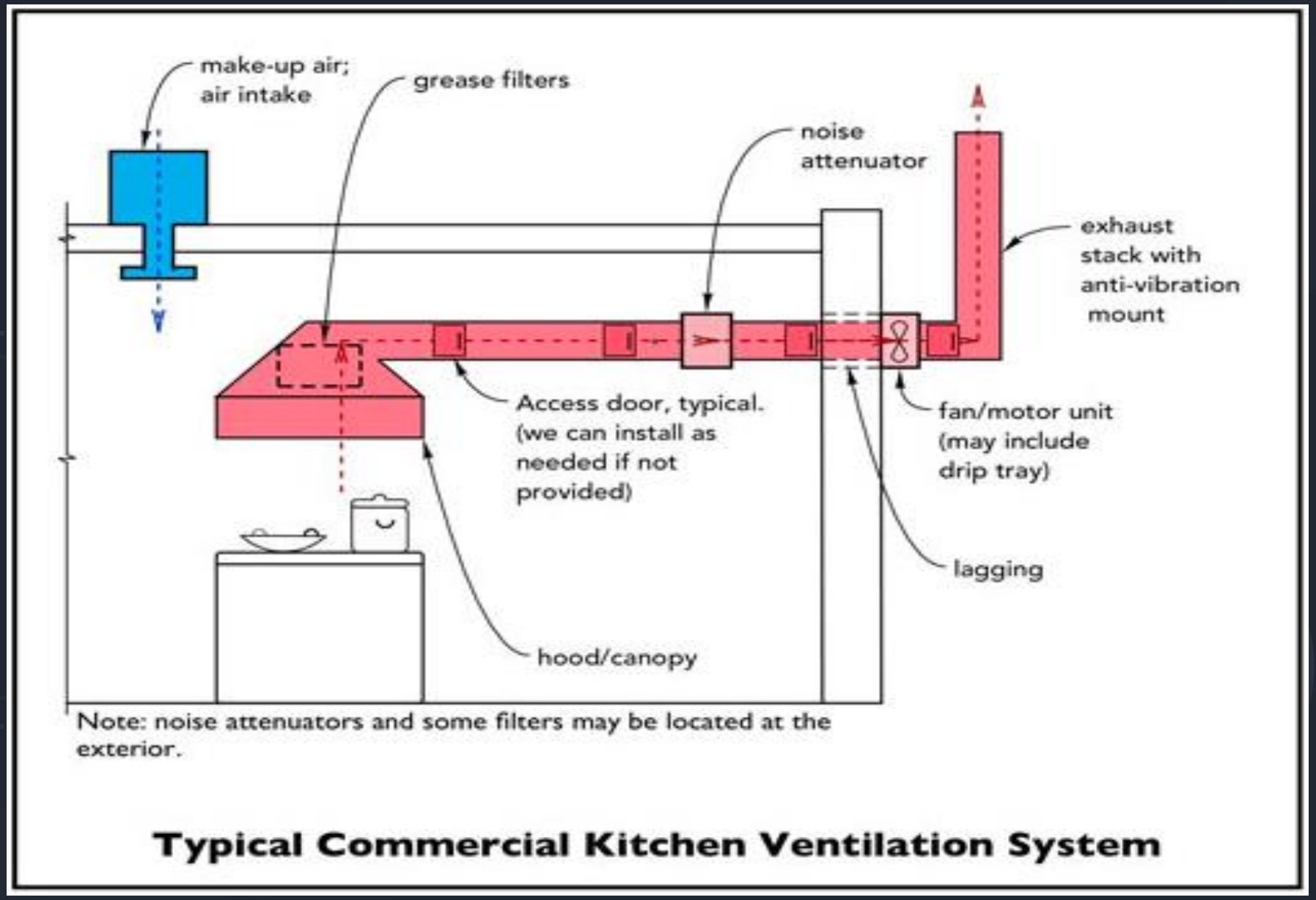
L. Bouroubia (2020): The Fluid Dynamics of Disease Transmission

Step 1 continued:

2. Examples of Extraction Hoods:

Step 1 continued:

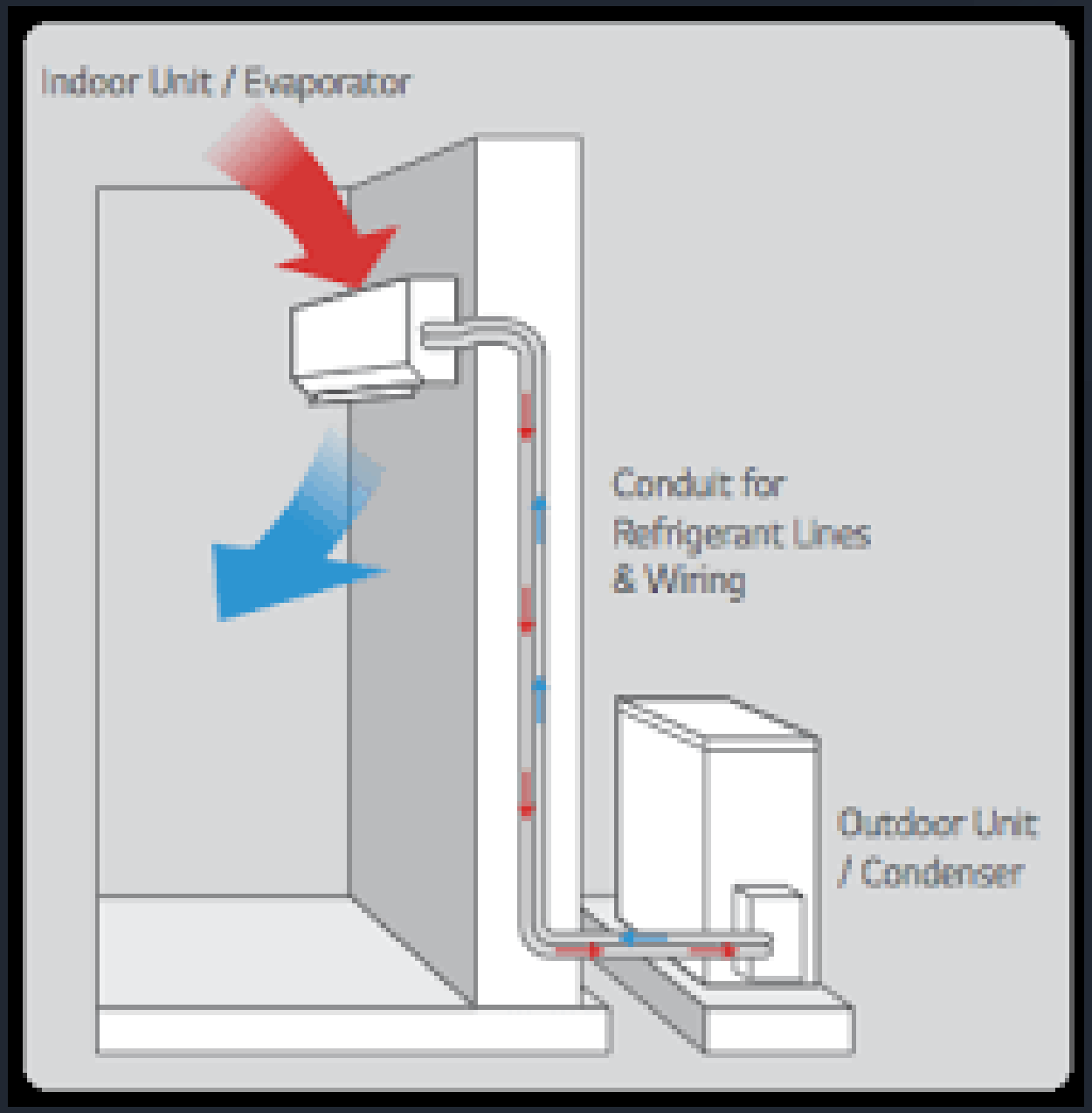
2. Examples of Extraction Hoods:



Typical Commercial Kitchen Ventilation System

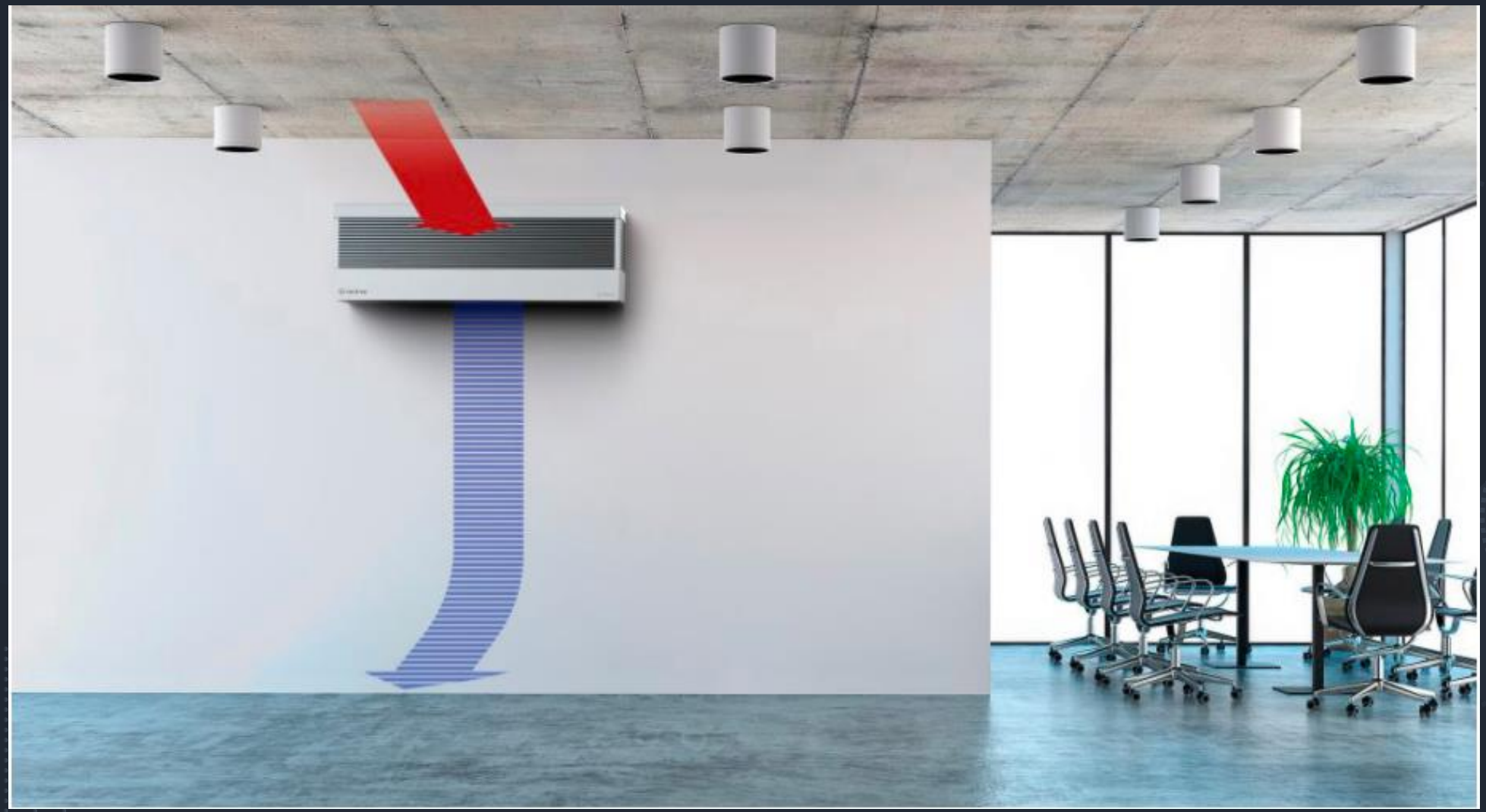
Step 1 continued:

3. Examples of Split Unit Air-Conditioners:



Step 1 continued:

3. Examples of Split Unit Air-Conditioners:



Step 1 continued:

3. Examples of Split Unit Air-Conditioners:

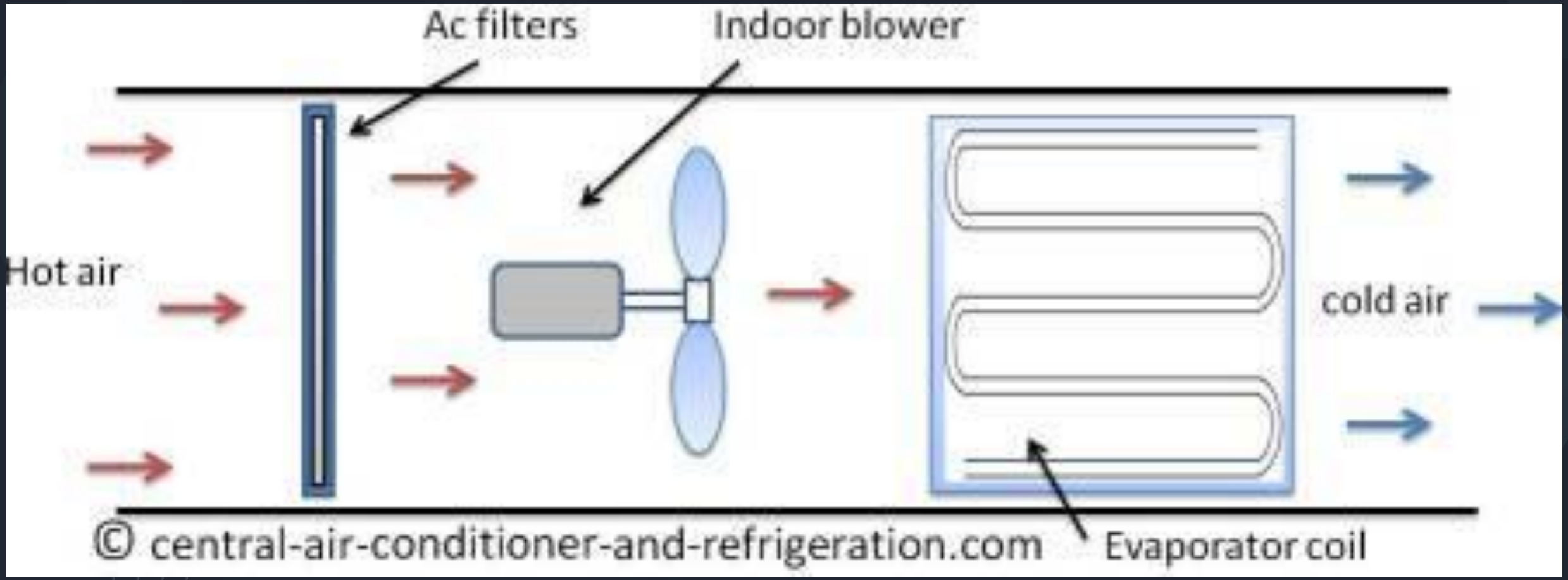
Step 1 continued:

Examples of HVAC or Central Air-Conditioning systems:

It is important to remember that if a central air-conditioning system does not provide a make-up component of fresh air, it should not be considered as a ventilation system

Step 1 continued:

Examples of HVAC or Central Air-Conditioning systems: Not a ventilation system



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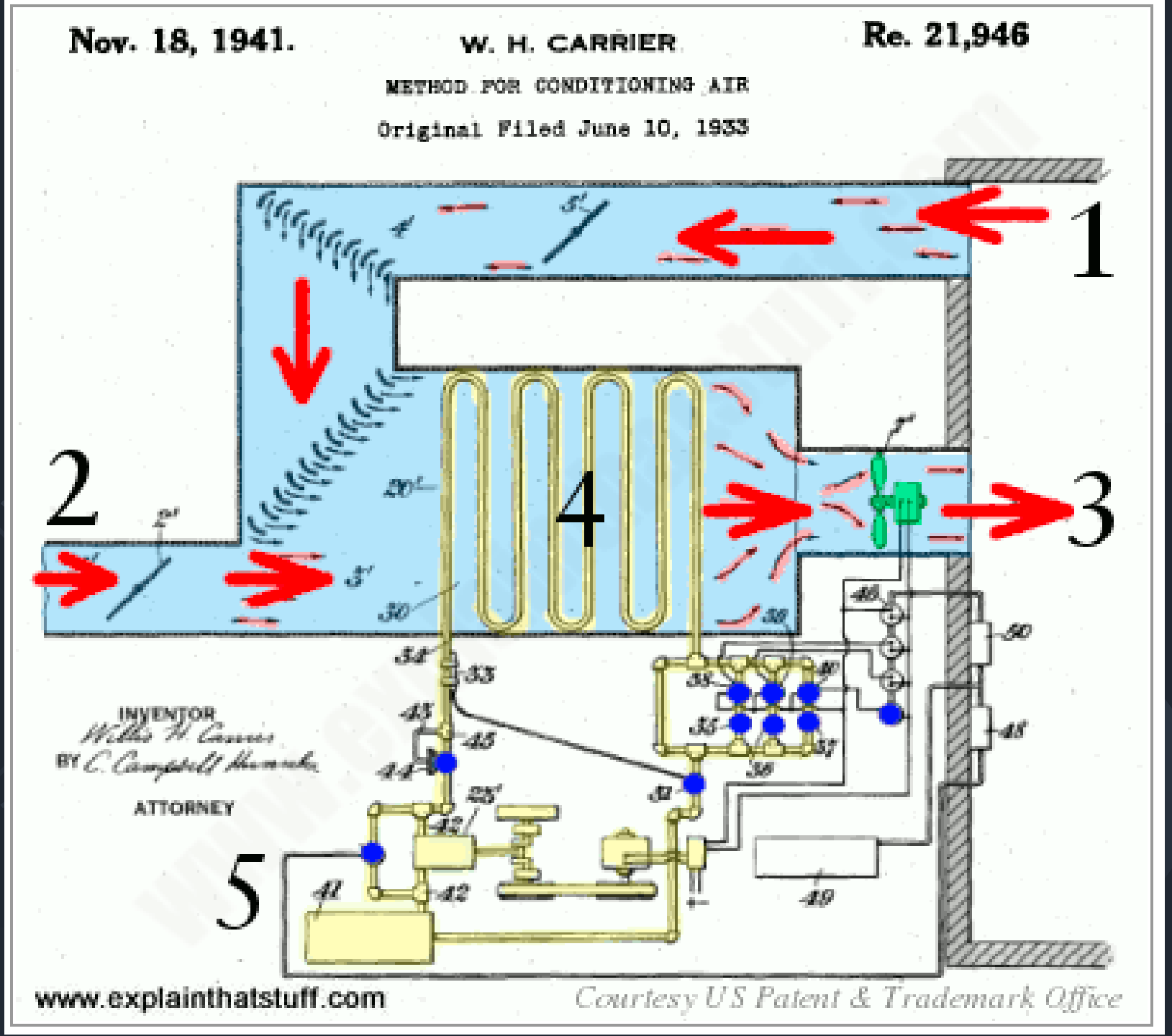
How does HVAC work:

Ventilation system



Step 1 continued:

Examples of HVAC or Central Air-Conditioning systems:

Return air grills

Diffuser outlets

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Check your Intakes

Sadly, air may come from here:

- Designers tend to hide all the ugly stuff in one place—including air intakes!

Monona Rossol, Back 2 Skool 2021: https://youtu.be/IKuLs9C4M9Q

Or air may come from here.

Check your Intakes

Exhausts from lab hoods and bathrooms commonly are near HVAC air supply units

Monona Rossol, Back 2 Skool 2021: https://youtu.be/IKuLs9C4M9Q

Standard Covid-19 Prevention Protocols: The Early Days

Wash your hands frequently with soap and water (40 seconds with no water waste) or use hands sanitizer especially when:

- going to the bathroom
- eating
- blowing your nose, coughing or sneezing
- using public transportation

Cover your mouth and nose with flexed elbow or tissue when coughing or sneezing

Avoid close contact with anyone who has fever and cough

Avoid touching eyes, nose and mouth with your hands.

Stay home and seek medical care immediately if you have fever, cough, shortness of breath and sore throat

Practise social distancing at 1.5 meter

Avoid crowded and mass gathering

No hand-shaking and any other type of physical contacts

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Top Five Risk Reduction Measures:

1. Vaccination
2. Ventilation
3. Masking
4. Vocalisation and Activity
5. Social Distancing